Radiation Hardness of DOIM

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DOIM for Run2a

- Laser Diode type: InGaAsP/InP, $\lambda = 1550$ nm.
- Threshold current: 10 mA for each diode.
- Operating bias: 20 mA for each diode(Fig 1).
- Typical light output: 200 μW to 800 μW.
- Exposed to 200 kRad (400 kRad), no significant change in IV curve of LD (Fig 2).
- But light output degrade to 87% (80%) (Fig 3).
- Maximum radiation tolerance $\sim$ 1 MRad(Fig 4).

New Technology

- VCSEL(Vertical Cavity Surface Emitting Lasers).
- Laser Diode type: GaAlAs, $\lambda = 850$ nm.
- Threshold current: 5 mA for each diode.
- Operating bias: 10 mA for each diode.
- Typical light output: 500 μW to 3 mW.
- Exposed to 2.0×10^{14} proton/cm^2 ($\sim$ 40 MRad), light output degrade to 30% $\sim$ 50% of the original level (Fig 5).
- For comparison, another 2.0×10^{14} proton/cm^2 were delivered to this VCSEL laser diode after being biased at 20 mA for 1 week. The annealing effect showed up at the beginning (Fig 6).
- Radiation tests for fiber, ASIC driver chip are in progress.

IV and LV Curves of LD for DOIM in Run 2a

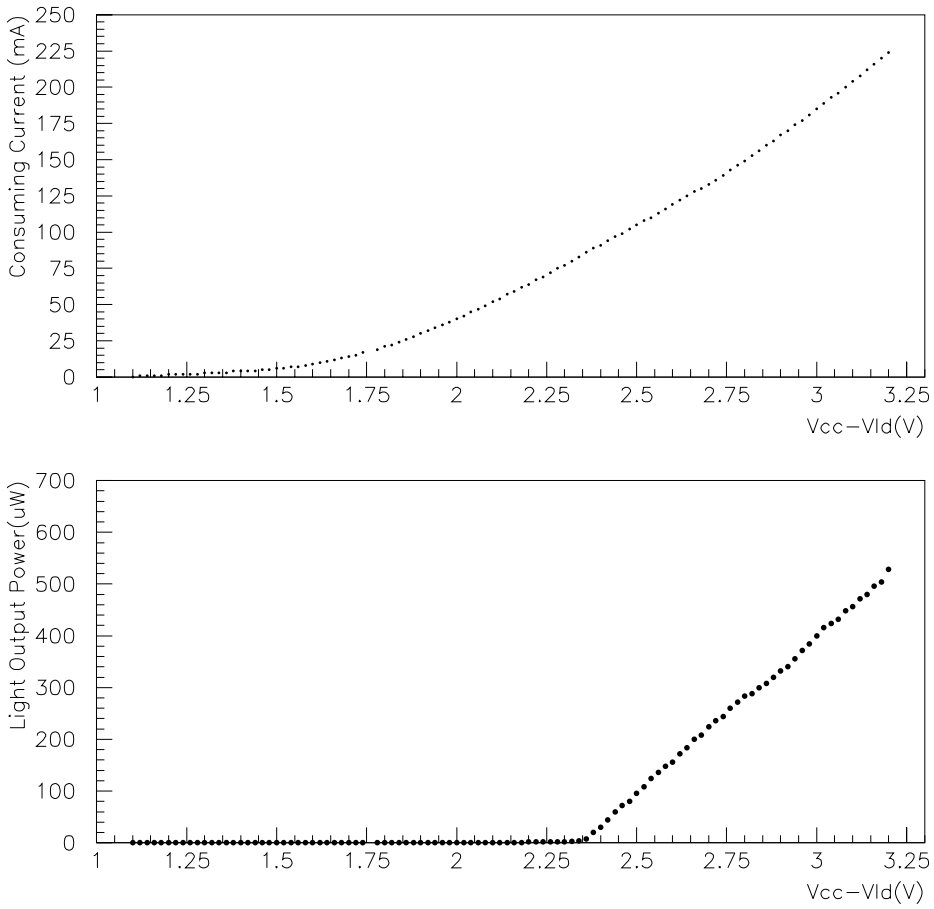


Figure 1:

No Significant Change in LV Curves

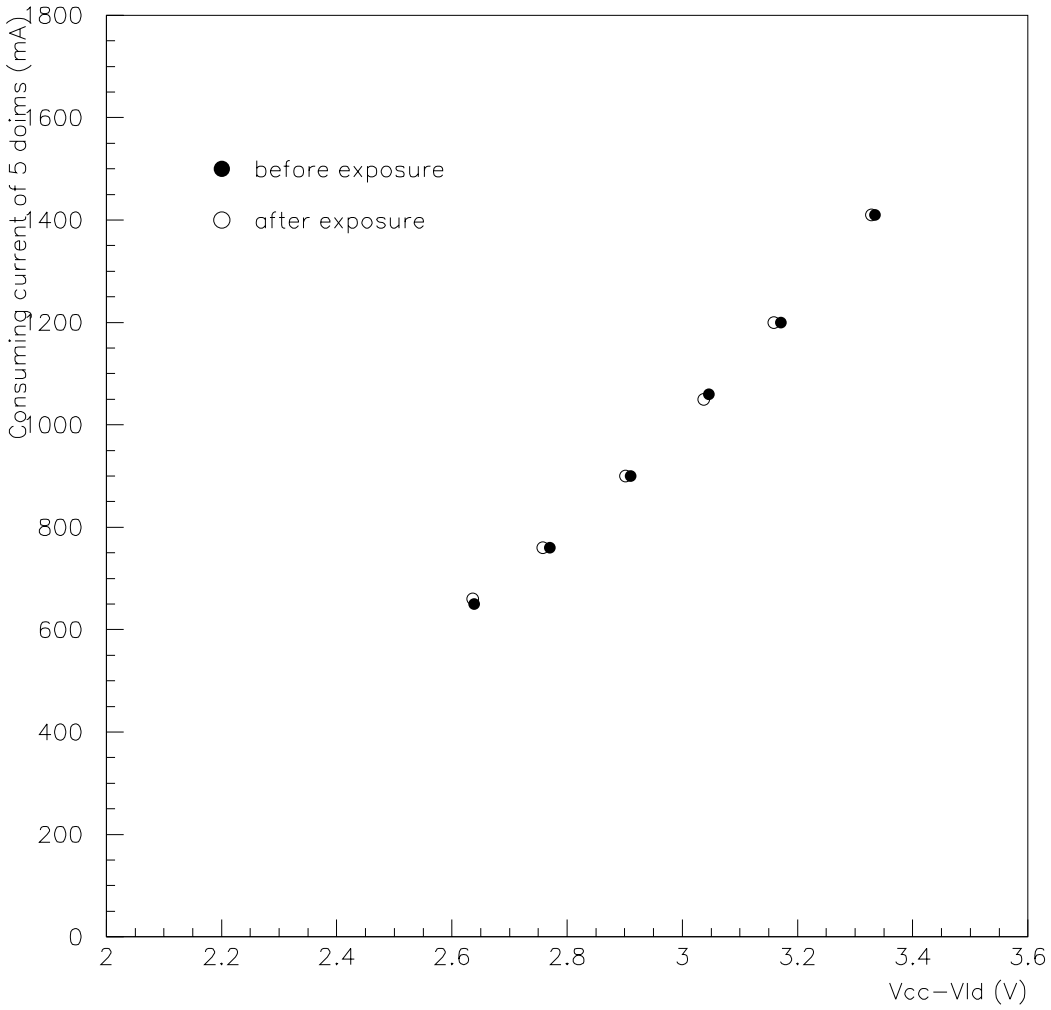
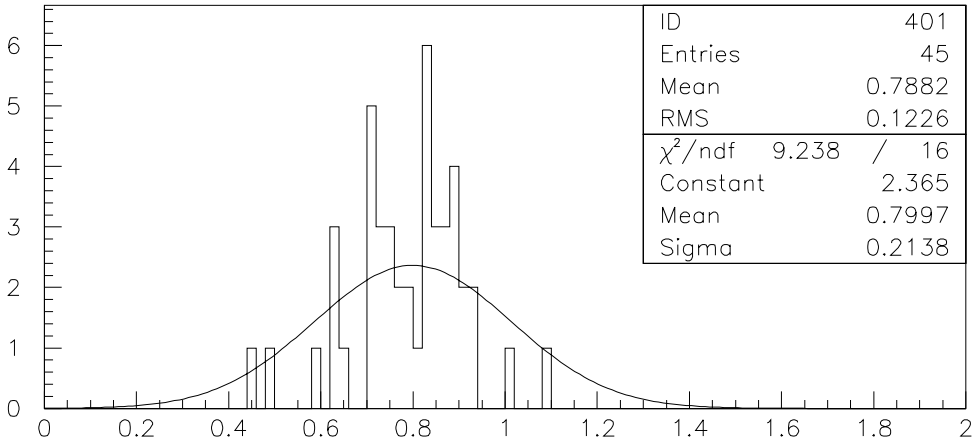


Figure 2:

Light Output Degrade



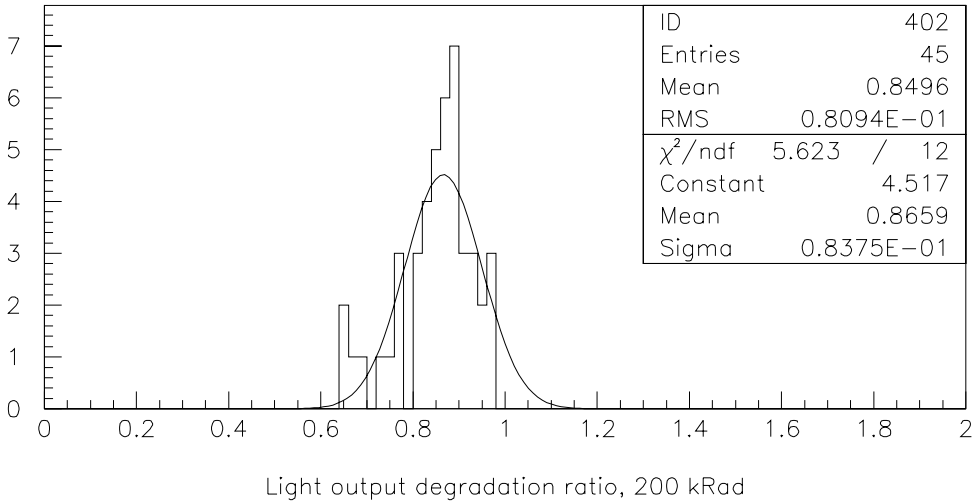


Figure 3:

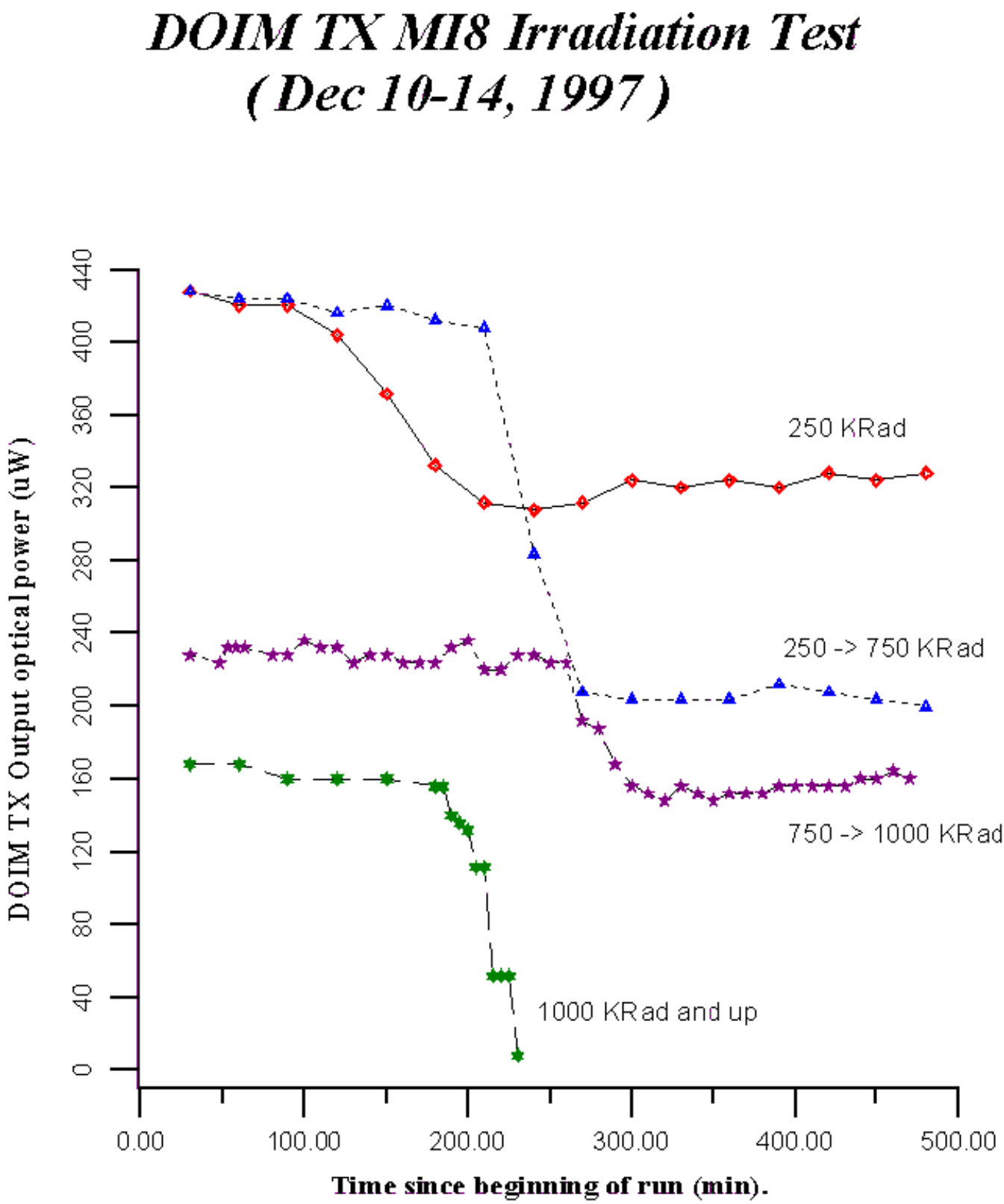

DOIM TX MI8 Irradiation Test
(Dec 10-14, 1997)
DOIM TX Output optical power (uW)
0
40
80
120
160
200
240
280
320
360
400
440
0.00
100.00
200.00
300.00
400.00
500.00
Time since beginning of run (min).
250 KRad
250 -> 750 KRad
750 -> 1000 KRad
1000 KRad and up

Figure 4:

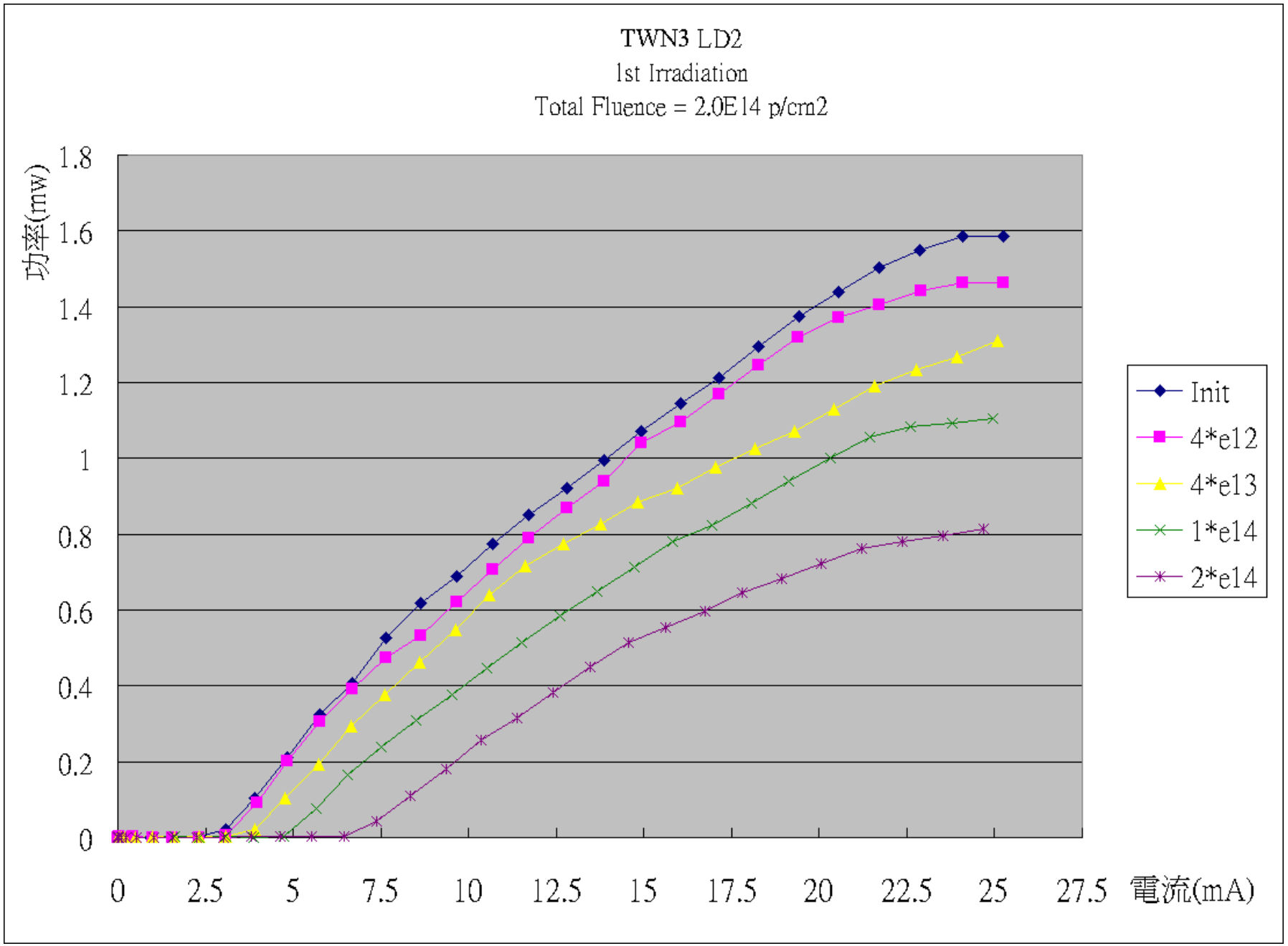

TWN3 LD2
1st Irradiation
Total Fluence = 2.0E14 p/cm2
功率(mw)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
27.5
電流(mA)
Init
4*e12
4*e13
1*e14
2*e14

Figure 5:

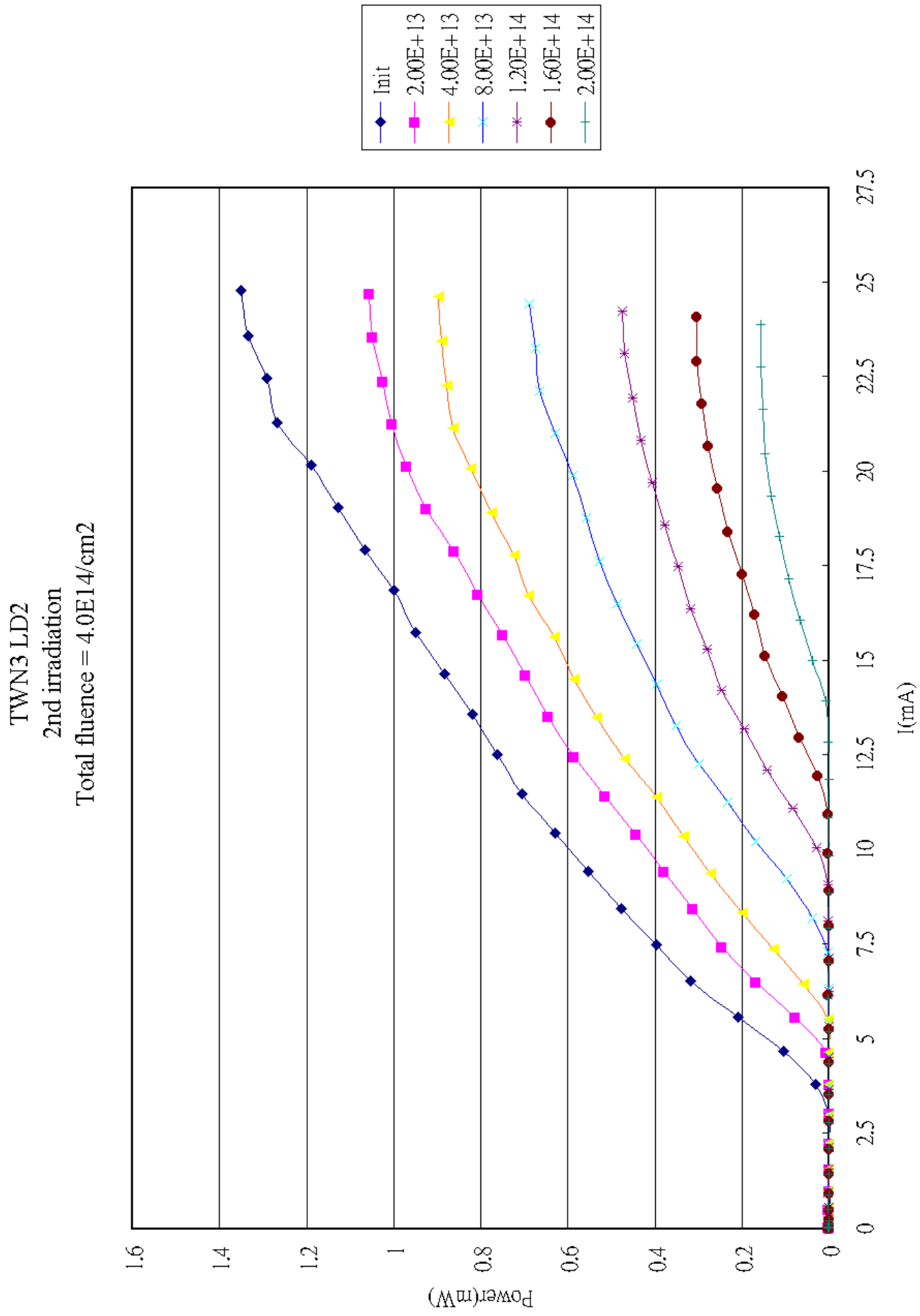

TWN3 LD2
2nd irradiation
Total fluence = 4.0E14/cm2
Init
2.00E+13
4.00E+13
8.00E+13
1.20E+14
1.60E+14
2.00E+14
Power(mW)
I(mA)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
27.5

Figure 6: